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ABSTRACT

Among the constructs commonly considered by career counselors are vocational interests, aptitudes, and personality variables. Although the predictive power of each of these domains with respect to successful occupational functioning has been demonstrated, little research has been conducted on the nature of their interaction. The interrelatedness of vocational interests, aptitudes, and personality traits was evaluated using a modified version of the Inter-Domain model postulated by Lowman (1991, 1993). Participants were 101 people aged 16 or over who were enrolled in state employment and training programs. These subjects were given a battery of four standardized psychometric instruments: (1) Sixteen Personality Factor Questionnaire, Fifth Edition (R. Cattell, H. Eber, and M. Tatsuoka, 1970); (2) Edwards Personal Preference Schedule (A. Edwards, 1959); (3) Self-Directed Search, Fourth Education (J. Holland, 1985); and (4) General Aptitude Test Battery (U.S. Department of Labor, 1982). Together these measured each of the three dimensions. Descriptive and discriminant analyses offered partial support for postulated construct relationships. Prediction of vocational interest category by personality, aptitude, and demographic variables was possible for some of the Holland categories. Implications for testing practices for youth and adults in secondary or postsecondary educational settings are noted. (Contains 6 tables and 51 references.) (SLD)

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Intra-Profile Relationships for Key Psychometric Variables in Occupational Evaluation

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Abstract

Several constructs are commonly considered by counselors assisting consumers with career counseling and subsequent job recommendations. These constructs are vocational interests, aptitudes and personality variables. Though predictive power for each of these domains with respect to successful occupational functioning has been demonstrated, little research has been conducted addressing the nature of their interaction. While some studies attempted to describe relationships for various pairings of aptitude, interest, and personality, very few have simulataneously addressed all three, despite initial calls for such research almost 60 years ago. The present study evaluated the interrelatedness of vocational interests, aptitudes and personality traits via a modified version of the *Inter-Domain* model postulated by Lowman (1991, 1993). Participants were 101 persons age 16 or over who were enrolled in state employment and training programs. Evaluees were administered a battery of four standardized psychometric instruments (*16PF, EPPS, Self-Directed-Search* and *GATB*) which together measured each of the three dimensions. Descriptive and discriminant analyses offered partial support for postulated construct relationships; prediction of vocational interest category by personality, aptitude and demographic variables was possible for some of the Holland categories. Implications for testing practices for youth and adults in secondary or post-secondary educational settings are noted.

Intra-Profile Relationships for Key Psychometric Variable in Occupational Evaluation

In Western society, work is a major source of status, identity and gratification. Increased understanding of the wide-reaching effects of participation in work have resulted in investigation of issues related to career choice and satisfaction (Yost & Corbishley, 1987). This movement has also served to facilitate improvement in career exploration and job placement tools (including psychometric instruments) and career counseling techniques (Watkins, Campbell, & Nieberding, 1994).

Of interest to researchers has been determination of how aptitude, personality and interest variables are related to one another, and whether these relationships differ by intervening variables such as gender, disability, and race. Most studies have looked at either the contribution of singular constructs (Ree, Earles, & Teachout, 1994) or the interaction of two constructs at a time, such as the combination of aptitudes and vocational interests. There have been some replicable findings for many of these studies, but overall data yielded has not been definitive.

Studies such as that of Gottfredson, Jones, and Holland (1993), Jin (1991), and Keller (1997) have found construct overlap between vocational interest dimensions and personality factors, even when measurement tools using varying theoretical bases were employed. Although descriptions of how these dimensions relate vary from study to study, the consensus is that each contributes uniquely to vocational assessment. Authors such as Randahl (1991) and Bolton (1988) have examined linkages between vocational interests and aptitude scores. In her study of 846 evaluees in a career counseling setting, Randahl concluded that abilities and interests exhibited relationships congruent

with descriptions of Holland interest dimensions, and that distinct typologies existed for persons who experience vocational difficulties.

In the last several years, more work has been published in which the three vocational constructs of interest, personality and aptitude were simultaneously addressed. Balgopal, McLean and Kaufman (1994) administered vocational instruments representing each of these categories to a sample of 874 individuals. They reported a modest degree of interrelationship for each of the three variable classes, with the strongest effect in connection with crystallized intelligence, or 'g.' In a recent meta-analysis and review of the literature, Ackerman and Heggestad (1997) maintained that integrated, cohesive representations that simultaneously address interests, personality and aptitude are possible, but that it is both difficult and impractical to attempt to heuristically account for all possible inter-domain relationships.

Periodic forays have investigated the effect of non-vocational variables on occupational choice. Gender has been reliably linked to occupational selection (Betz, 1992; Gottfredson, 1978). Membership in a diverse ethnic group (Avolio & Waldman, 1994; Cohn, 1997; Constantine, Erickson, Banks, & Timberlake, 1998; Fouad, 1994; Ogbu, 1989) and socioeconomic status (Betz, 1992; Meier, 1991) are also noted influences with respect to vocational concerns discussed in the literature.

Group differences have been documented with respect to vocational interests, aptitude scores and personality scale endorsement. Some studies have attempted to control for competing variables such as disability, age, and educational level, with mixed levels of success. Overall, the findings of past studies have substantiated that such variables do play a significant role in career development and eventual occupational choice, but the extent to which these mitigate vocational perceptions and assessment performance is still in question.

To summarize the literature, there has been increased attention to career related issues in recent years for various reasons. This is largely due to the realization that certain groups such as persons with disabilities (Conte, 1983; Hershenson & Szymanski, 1992) and ethnic minorities (Arbona & Novy, 1991) were still not realizing their vocational potential. This attention is also in response to changes in the workplace, for example, greater demand for workers with high-tech skills. In recognition of these issues, increased numbers of research projects dealing with vocational issues have been undertaken (Fouad, 1994). While this has resulted in knowledge gains, there is also an acknowledgment that in general, treatment of topics have been extensive in breadth but not depth (Meier, 1991). This circumstance has served to restrict progress in vocational research and practice. Researchers such as Betz (1992) have advocated that construction of new instruments should be based on a strong conceptual knowledge of critical factors important in choosing and maintaining employment.

Hypotheses and Variable Selection

Research questions were designed to explore the hypothesized relationships between occupational constructs as presented in a modification of Lowman's (1991) *Inter-Domain* model. Lowman's model holds that higher or lower levels of certain aptitudes are associated with specific Holland interest areas. These in turn are related to the relative presence or absence of certain personality characteristics.

In his conceptualization, Lowman includes some traits that, while relevant vocationally, tend to be important for a smaller number of jobs. Thus, the decision was made to modify his model to encompass variables more commonly measured by practitioners in the field. His model is illustrated in Table 1 below.

Table 1

Vocational Correlates of the *Inter-Domain Model*

Interests	Abilities	Personality
Realistic	+ Mechanical	+ Introversion
	+ Spatial	- Intellectance
	- Verbal	- Ascendance
	- General Learning	+ Masculinity
	- Social/Interpersonal	- Self-Control
		+ Tough-Mindedness
Investigative	+ Reasoning	+ Self-Control
	+ General Learning	- Agreeableness
	+ Convergent Thinking	- Ascendance
		+ Intellectance
		+ Introversion
		+ Masculinity
		+ Tough-Mindedness
		- Adjustment
Artistic	+ Aesthetic Judgment	- Agreeableness
	+ Divergent Thinking	- Tough-Mindedness
	+ Spatial/Musical Ability	+ Introversion
Social	+ Social/Interpersonal	+ Adjustment
	+ General Learning	+ Ascendance
		+ Intellectance
		- Introversion
		+ Likability
		- Masculinity
		+ Self-Control
		- Tough-Mindedness
Enterprising	+ Organizing/Managing	+ Adjustment
	+ General Learning	+ Ascendance
	+ Social/Interpersonal	- Introversion
		+ Masculinity
		+ Self-Control
		+ Tough-Mindedness
Conventional	+ Perceptual Accuracy	- Ascendance
	+ Numerical	- Intellectance
		+ Introversion
		- Masculinity
		+ Self-Control
		+ Tough-Mindedness

Note. Valences (+,-) indicate theorized relationships of listed attributes with each Holland interest category. For example, for the Realistic interest area, a (+) beside Mechanical Ability indicates association of high degree for that ability with strong Realistic interests. The (-) with respect to Intellectance mean a low association with that trait in conjunction with Realistic interests.

However, identification of instruments was necessary in order to obtain actual data that might support or refute Lowman's (1991, 1993) framework or in this case, a modified representation of that model. Table 2 illustrates a modification of Lowman's original framework.

Table 2

Extension of *Inter-Domain Model* as Related to Vocational Scales

Interest (*SDS*)	Abilities (*GATB*)	Personality (*16PF* and *EPPS*)
Realistic	+ Manual Dexterity	+Reserved (16PF)
	+ Spatial	-Intellectance (16PF)
	- Verbal	+Surgency (16PF)
	- General Learning	+Emotional Stability (16PF)
	+ Form Perception	+Tough-Mindedness (16PF)
		+Practicality (16PF)
Investigative	+ General Learning	+Autonomy (EPPS)
	+ Verbal	+Emotional Stability (16PF)
		+Intellectance (16PF)
		+Reserved (16PF)
		+Tough-Mindedness (16PF)
Artistic	+ Spatial	+Imaginative (16PF)
		+Exhibition (EPPS)
		+Adventuresome (16PF)
		+Low Ego Strength (16PF)
Social	+ General Learning	+Outgoing (16PF)
	+ Verbal	+Intellectance (16PF)
		+Affiliation (EPPS)
		+Surgency (16PF)
		+Nurturance (EPPS)
Enterprising	+ General Learning	+Surgency (16PF)
		-Intellectance (16PF)
		+Dominance (EPPS)
		+Tough-Mindedness (16PF)
Conventional	+ Clerical	+Controlled (16PF)
	+ Numerical	+Deference (EPPS)
		+Order (EPPS)
		+Surgency (16PF)
		+Reserved (16PF)

Note. Valence signs (+,-) indicate the theorized relationships of aptitude and personality scales with Holland interest categories. For example, for the Enterprising interest area, a (+) beside General Learning Ability indicates that a high score on that scale is associated with Enterprising interests. By comparison, the (-) for Intellectance denote the likelihood of a lower score for that scale for persons whose primary interests lie in the Enterprising dimension.

Demonstration of the accuracy of a modified Inter-Domain model could result in several outcomes. A better understanding of the relationships between occupational variables could assist practitioners in instrument selection for vocational assessment. Accordingly, research questions of interest in this study were:

(1) Does the modified Inter-Domain model constitute an accurate representation of the relationships between the three categories of vocational traits?

(2) Is the predictive value of the above model mediated by other variables, such as socioeconomic status or gender?

As mentioned previously, variables were chosen in conjunction with those included in the Inter-Domain model as well as traits frequently measured by vocational evaluators. Vocational interests were defined as those represented by the Holland hexagon in conjunction with Holland's Theory of Work Personality, and measured by administration of the *Self-Directed Search, Fourth Edition* (Holland, 1985). Aptitudes used were selected from those defined by the U.S. Department of Labor and incorporated into the *General Aptitude Test Battery*, or *GATB* (U.S. Department of Labor, 1982). As an exploratory effort, this study incorporated only those aptitude variables addressed within both the structure of the modified Inter-Domain model and measured by the *GATB*. As with selection of aptitudes, personality variables investigated were those synchronous to the modified Inter-Domain model, and measured by personality instruments appropriate for vocational applications. The measures used were the *Sixteen Personality Factor Questionnaire, Fifth Edition* , or *16PF* (Cattell, Eber, & Tatsuoka, 1970) and the *Edwards Personal Preference Schedule*, or *EPPS* (Edwards, 1959).

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Participants

Consumers approached for involvement in the study met several criteria. Each resided in the same Southern state, were aged 16 or older, and were receiving employment-related services. A small number of people (n=6) were also identified during or after testing (either by themselves or program staff) as having been administered one or more of the measures used in this investigation. In such cases, the researcher inquired as to the length of time since administration. If it had been less than six months, then the data for the measure(s) in question was discarded and not included in the analysis.

Attempts were made to ensure representation of persons from both rural and urban areas in that contacts were made with program administrators from four geographical areas of the state. However, logistical issues (i.e., seasonal activities) resulted in participants being obtained from only one metropolitan site, thus eliminating geographical location as a potential variable of interest. Additionally, external factors such as "no-shows" for scheduled testing sessions, data that had to be discarded due to invalid test profiles, and the caseload makeup for agency counselors did not permit random collection of data. Although available data for persons enrolled in such programs nationwide do not suggest a substantial deviation from attributes characterizing these populations as a whole (Nightingale, Yudd, Anderson & Barnow, 1991; U.S. General Accounting Office, 1991), the lack of random selection served to restrict the generalizability of the findings. Table 3 shows subject distribution on key characteristics, chosen as variables of interest based on information provided in the literature indicating potential impact on career development and occupational choice.

Table 3

Description of Subject Characteristics

Variable	Agency Affiliation			
	VR		ES	
	n		n	
Site				
(a) Urban	26	(63)	57	(100)
(b) Rural	16	(36)	0	(0)
Work History				
(a) Skilled	2	(4)	0	(0)
(b) Semiskilled	5	(11)	19	(33)
(c) Unskilled/no work history	32	(72)	27	(47)
*Missing data	5	(11)	11	(20)
Gender				
(a) Male	25	(56)	18	(31)
(b) Female	19	(43)	39	(68)
Age				
(a) Youth (16-21)	39	(88)	37	(64)
(b) Adult (22+)	5	(11)	20	(35)
SES				
(a) Upper	3	(6)	0	(0)
(b) Middle	18	(40)	11	(19)
(c) Lower	18	(40)	34	(59)
* Missing data	5	(11)	12	(21)
Race				
(a) White	21	(47)	3	(5)
(b) Black	23	(52)	54	(94)
Grade				
(a) <12th	14	(31)	32	(56)
(b) 12-13	26	(59)	18	(31)
(c) 14+	4	(10)	7	(12)

Note. Percentages may not add up to 100% due to rounding.

Interest in obtaining urban and rural participants was twofold: both to help ensure generalizability and because location could impinge on exposure to various occupational choices and assumptions about the number of career opportunities available locally. Work history could serve as one indicator of the types of exposure individuals have had to

the working world and constitute an interesting comparison with aspired-to occupations identified by each subject.

Gender has been associated with occupational choice and scores on a number of occupational scales. Data on age was collected because of the possibility that age could potentially impact the strength of association for the classes of vocational traits being examined, possibly connected with level of career maturity. Socioeconomic status has been discussed in the career literature as a factor in occupational choice (Malnquist & Eichorn, 1969), but there exists little empirical data to describe its potential effects. As with gender, race or ethnicity has been widely discussed in terms of its impact in career selection, and seemed a particularly relevant variable to evaluate in conjunction with work history and aspired-to occupations. Finally, grade or education level, particularly as it might relate to ability scores or interest variables, was identified as a variable with potential mitigating effects for vocational issues.

On average, subjects were young (16-21 years in age), Black and resided in urban areas as defined by the U.S. Census Bureau (U.S. Department of Commerce, 1994). Most participants reported having either no or an unskilled work history, according to U.S. Social Security Administration job classifications, and had completed twelve years of education. Subjects were more evenly distributed by sex and largely lower or middle socioeconomic status (Kacapyr, 1996; U.S. Department of Commerce, 1991, 1994).

Both youth and adult subjects were included in this study. Many employment and training programs use age 21 as a cutoff point after which applicants are classified as adult enrollees.

Materials and Instrumentation

Materials used in this study consisted of a researcher constructed self-report work history profile, institutional consent form, summary score report, and four widely-used, standardized vocational assessment instruments: the *16PF*, *EPPS*, *GATB* and *SDS*. All aptitude, interest and personality data were gathered via administration of these instruments. These measures were selected because of their established technical properties, their widespread use by evaluators, ease of administration and number of subscales corresponding to the original (Lowman) model.

Demographic information was obtained through completion of the self-report work history profile. Personality and occupational interests were obtained via scores on the *16PF*, *EPPS* & *SDS*, while the vocational aptitudes of interest were assessed using six timed subtests (Verbal Ability, Numerical Ability, Spatial Aptitude, General Learning Ability, Form Perception and Clerical Perception) from the *GATB*. These six subtests of the GATB (from the total of nine that make up the battery) were chosen as variables for several reasons. Each of these variables fit well with the original Lowman model; this group of variables, either singly or in combination, are important for competent performance for most types of jobs. Finally, all of the above aptitudes are often routinely assessed during vocational evaluations and most have multiple instruments designed for their measurement.

Design and Procedure

Agency administrators were approached for project approval and names of departmental or local supervisors in four geographical areas of the state who would act as site coordinators for data collection. These geographical regions or districts were chosen in conjunction with the agency administrators recommendation both to ensure geographical

representation and sufficiently large subject pools. After initial contact with these supervisors concerning the parameters of the project, each provided the names of the case managers or counselors working with individuals meeting requirements for participation in the study. These requirements were that the potential evaluees be age 16 or over and able to benefit from a vocational evaluation. Some individuals who already had assessment data on file were offered by case managers, in an effort to assist the evaluator, as possible evaluees. These persons were not accepted for testing unless the testing provided through the study would provide supplemental information or clarification for the previous evaluation results. Counselors were told that potential evaluees needed reading ability on at least a fourth-grade level in order to be able to comprehend and respond to the testing materials.

The researcher then obtained from these case managers or counselors, either by telephone or in person, the phone numbers for and names of persons on caseload who might meet criteria for the study and who might also be interested in receiving a vocational evaluation. Subjects were then contacted by either the case manager or the researcher to solicit subject or parental agreement to participate and set up a testing date.

Testing sessions were typically arranged for three to six persons; all materials used could be appropriately administered in either a group or individual format. Each testing session began with the researcher providing set information on how the vocational evaluation was to proceed, its purposes and how the results would be reported and used. Evaluees were asked to sign a consent form before beginning and complete a researcher-constructed work profile form. The first instrument selected was always the *Self-Directed-Search* (*SDS*), chosen since it is relatively non-threatening, untimed and "user-friendly." As

each individual completed the *SDS*, remaining measures were administered. The order of administration for these subsequent tests was varied for minimization of sequencing effects and ease of session monitoring by the researcher. During the course of the three to four hour testing period, subjects were permitted a 10-15 minute break during testing, with additional breaks available upon request.

After completion of testing, the researcher hand-scored each protocol and computed standard scores and percentages where applicable for each instrument. These scores were then compiled into a "Summary Score Record" which was sent to the case manager with evaluee permission, or directly to the evaluee if requested. All participants were informed either the researcher or agency personnel would be available to discuss the test results and answer questions regarding the research project or their results. With respect to analyses, the test scores for each variable under study were entered by the researcher into the *SPSS for Windows* (Version 6.0; Norusis, 1994) data file for statistical treatment. All questionable data, such as personality profiles indicating high levels of impression management or responses obtained after recent administration of the study instruments from another source, was not included in the compilation and was treated as missing data. A copy of the subject's summary score report and test materials was retained by the researcher, identifiable only by assigned subject ID number. Data were analyzed by a discriminant analysis procedure conducted via *SPSS for Windows*.

Results

A discriminant analyses was performed using respondent Holland code as the grouping variable and each of the aptitude and personality subscales as predictor variables. Predictor variables of gender and

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socioeconomic status were also used in the analysis to answer the third research question.

Of the original 101 cases, seventeen had missing data. Examination of the data set indicated that the missing data appeared to be randomly scattered throughout the groups and predictors. The decision to replace missing values with the group mean for the variable in question was made per suggestions in the literature and the sensitivity of discriminant analysis to missing data (Norusis, 1994; Tabachnick & Fidell, 1989). Neither multicollinearity nor homogeneity of variance constituted threats to the validity of the analyses. Five discriminant functions were derived. Table 4 summarizes those findings.

Table 4

Discriminant Function Variable Correlations Grouped by Holland Codes

	Standardized coefficients of primary predictor variables with discriminant functions							
Predictor	1**	2*	3	4	5	Wilk's Lambda	F	Sig.
SEX	1.22					.506	10.54	.000
NURTURE	-1.21					.916	.99	.435
SPATIAL	.91			.64		.771	3.22	.013
RESERVED	.83					.953	.53	.750
CLERICAL		-1.09				.904	1.14	.349
DOMINANCE		-.95				.879	1.49	.210
GENERAL LEARNING	.96					.899	1.21	.315
EMOTIONAL STABILITY			-.93	.71		.917	.98	.440
LOW EGO STRENGTH			.90			.934	.76	.581
EXHIBITION					-.58	.920	.94	.460
					59			
INTELLECTANCE				.68		.940	.70	.629
FORM PERCEPTION					.79	.911	1.06	.392
SURGENCY			.76		.64	.873	1.57	.185

*Note. Functions 1 and 2 (*) explained 61.57 & 17.81 (79.38 total) percent of the between-groups variance. Functions 3-5 accounted for <10% each. Function 1 represents persons reporting Realistic interests on the SDS; Function 2 indicates subjects with Social interests.

In evaluating the choice of analyses and their subsequent results, an advantage of discriminant analysis over related statistical procedures such as MANOVA is that groups can not only be predicted and categorized, but that the nature of those relationships may be interpreted (Tabachnick & Fidell, 1989). This process operates much in the same way as dimensions are interpreted following a factor analysis (Betz, 1987). Evaluation of the group means and the standardized coefficient loadings for the discriminant function seemed to best separate individuals preferring occupations of the Realistic type. The attributes associated with the first function - predominately male, less nurturing, more reserved and with higher Spatial Ability scores - are supported by previous findings in the career literature (Randahl, 1991) and provide partial support for an Inter-Domain type model (Lowman, 1991).

In contrast, the variables comprising the second equation - higher scores on General Learning, lower scores on Dominance and Clerical Ability - seem to suggest persons who have a preference for Social occupations. This configuration does differ somewhat from that reported in previous research. For example, Randahl (1991) found Clerical Perception, Motor Coordination and Verbal Ability to be generally higher-scoring areas for persons with Social interests. These contrasting results may be accounted for at least in part to differences in research samples between the present study and that mentioned above. Also notable is that effects for only two of the variables (gender and Spatial Ability) were substantial enough to be statistically significant at the .05 level or greater. Further, none of the discriminant equations themselves approached statistical significance at the .05 or even the .10 level.

In addressing the three remaining functions, these together account for less than 10% of the variance between the groups (less than

10%) and consequently are more difficult to interpret. Additionally, due to the low number of subjects reporting Investigative and Enterprising Holland codes, efforts at further interpretation(s) may be specious and should be considered with great caution. With these strong caveats, the fourth function appears to possibly be indicative of persons preferring Investigative occupations. Clearly, this possibility needs corroboration by further research. This indicates that though clinical or practical associations seem to exist, the relationships may not be well-defined.

A last, but very important, aspect of this analysis involved the classification procedure. A split-sample methodology in which a randomly selected holdout subgroup of the entire sample was employed for purposes of cross-validation and to increase the probability that the findings would be generalizable (Betz, 1987; Huck, Cormier & Bounds, 1974). Table 5 summarizes the results of that portion of the analysis.

Table 5

Discriminant Classification Rates by Holland Code

Holland Code	n	Percentage Classified Correctly (N=101)
Realistic	24	92%
Investigative	5	60%
Artistic	17	95%
Social	30	97%
Enterprising	5	40%
Conventional	20	90%
Total N:	101	Overall Classification Rate: 86.67%
		Cross-Validation Classification Rate (n=60) : 88.24%

The percentage of persons correctly categorized by Holland code reinforced the assertion that predictors from each category appear to be important indicators of vocational preferences. The correct groupings greatly exceeded the chance rates of .23, .04, .16, .29, .04 and .19, respectively. These results should be considered preliminary until replicated by additional research, for two primary reasons: the lack of

statistical significance for the discriminant equations and the very low number of subjects in certain categories. In fact, two viewpoints in the literature are that there should be at least 20 subjects per each grouping or dependent variable, or as many subjects for each grouping variable as there are predictor or independent variables (G.L. Halpin, personal communication, October 26, 1997; Tabachnick & Fidell, 1989) which for this study would be 25. Keeping these two guidelines in mind, then tentative conclusions can be drawn at most for the Realistic, Social and Conventional Holland categories and most likely only for those reporting Realistic preferences.

With respect to the second research question, results for some of the demographic variables (gender primarily) have been discussed in some detail. Predictors of interest were gender, urban versus rural geographic location, race, age, education level and socioeconomic status. These were chosen from suggestions in the literature as to possible mediating variables relevant to career development and subsequent occupational choice. Of these predictors, some were not included in the analysis due to discrepancies in the characteristics of the research population. For example, the majority (77%) of the subjects were Black, while the remainder were White.

While gender was a statistically significant predictor for selection of Holland code, socioeconomic status was not an important variable in any of the functions generated. The role of socioeconomic status in occupational selection has not been widely discussed in the literature. Differences have been established for the role of gender on career development and relative performance on vocational assessment instruments (Betz, 1992; Fouad, 1994). Table 6 delineates the contribution of gender and socioeconomic status to the analyses.

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Table 6

Discriminant Analysis Contributions for Gender and Socioeconomic Status

Grouping Variable	Standardized Discriminant Coefficient
Holland Code	
Function 1	
Gender	1.22*
SES	-.028
Function 2	
Gender	-.253
SES	.002
Function 3	
Gender	.329
SES	-.340
Function 4	
Gender	-.209
SES	.075
Function 5	
Gender	-.063
SES	-.316

Wilk's Lambda	F	Significance
Gender	.506	.000***
SES	.940	.637

Note. An asterisk (*) indicates a primary predictor variable for its associated discriminant function. ***$p<.001$

Discussion

Partial support for a modified version of Lowman's (1991) theoretical structure was obtained. Cumulative research efforts have effectively established that linkages exist between certain constructs in each of the three primary areas of vocational assessment - interests, aptitudes and personality. Information garnered in this study reinforced the majority of findings in the career literature, which is that only

some variables from each vocational category demonstrate solid, replicable relationships with one another.

One explanation may be that for given vocational preferences, there is more within-group variance than for others. For example, the overall relationship that Realistic interests have with vocational aptitudes or personality traits may be stronger than that which exists for, say, Social interests. This possibility is given additional credence by the classification rates by Holland code shown in Table 5, particularly since categories with fewer subjects should actually have been overclassified using this procedure (Tabachnick & Fidell, 1989).

If true, this means there is more diversity among individuals who express preferences for, and similar likes to, persons in the occupations in question. Thus, interpretation of vocational assessment data and subsequent occupational recommendations would be more involved and potentially a more error-ridden proposition. This is especially true when considering the present study, in which the variables which contributed most to the second and third discriminant functions were ones not typically identified in the literature. Empirical verification would benefit practitioners through alerting vocational psychologists and other occupational counselors that more detailed consideration of vocational data may be needed for persons indicating a desire for occupations in certain categories. The end effect of this would ideally be more accurate career and placement recommendations.

A consideration of note is that only the dominant Holland type (interest area with the most points) was used in construction of the vocational profile. Though this is in keeping with the model originally presented by Lowman (1991), as well as more manageable statistically, it does introduce questions regarding interpretation. Normally when the *Self-Directed-Search* is employed, a three-letter code consisting of the

three (out of six) most highly endorsed types is generated and used in career counseling. Further, according to the "Rule of Eight," (Rayman, 1998), interest areas with less than eight points differentiation between them indicate a similar level of affinity for each and thus should each be looked at in the code. The implications are that if subjects showed eight points or less between the first choice or letter of the Holland code and the second, then the second choice could probably have served as well (i.e., substituted) in the evaluee's profile and the statistical analysis. This underscores the need for further examination which takes into account such factors.

Another explanation for the findings relative to both research questions may lie in the inherent methodological difficulties presented by combinations of instruments. For example, the Holland categories may be found to have greater or lesser predictive value with respect to certain aptitudes and/or personality traits than the interest dimensions of the *Kuder* or the *COPS*. Also, for each vocational construct there are numerous scales across instruments having varying degrees of concurrent validity with measures purporting to measure the same construct. There also exist some scales unique to certain instruments that cannot be directly compared to scales used in other measures.

Operational definitions also play a role, even between researchers and test manufacturers. For example, Lowman (1991, 1993) may have had a slightly different meaning for visuospatial ability than that used by the *GATB*, and both may be different from the Spatial Ability subtest as measured by other commonly used instruments. These are complex issues presenting logistical dilemmas for methodological design, but which could contribute to our understanding of these relationships.

Other methodological concerns were present that served as limitations to the study. Low statistical power due to small numbers of subjects per cell or condition of analysis (Keppel, 1991), missing data, and lack of random selection all constituted problems in evaluating these results and in the ability to generate analyses for certain variables of interest, such as age, education level, geographic location and SES. On this same note, although use of a hold-out sample does assist with determination of both internal consistency and external generalizability, the sample size should again provide reason for tentativeness in determination of the extent to which these findings may apply to other groups.

Another issue that constituted procedural concerns was the effort to match instruments and scales to Lowman's (1991, 1993) model, introducing potential for error for each subscale that was included or excluded in the modified model. Lastly, it may be that measures of other vocational constructs, notably career maturity, should have also been administered in light of the findings. Amelioration of these problems would eliminate potential confounds in future research efforts.

Potential confounds that were addressed included anticipation of order-of-administration effects. Measures used remained constant throughout the study, and with the exception of the non-threatening SDS, the presentation of measures occurred in no particular order, thus minimizing likelihood of primacy effects and depression of certain scores due to test fatigue. Although an assortment of issues relative to subject selection have already been illuminated, the researcher attempted to minimize bias to a certain degree in soliciting subjects from employment and training programs which are national in scope and which utilize similar criteria for eligibility across the country.

The last research question dealt with the relative contribution of demographic or other identifying variables external to those measured by the testing instruments. Variables identified were ones that have been addressed in the counseling literature as differentiating between people experientially and perceptually (i.e., gender, age, ethnicity/race, geographic location, education level and socioeconomic status). Unfortunately, the majority of the variables were not included in the analysis due to sampling issues. Effects of both gender and socioeconomic status (SES) are documented in Table 4.

The statistics concerning gender are not all that surprising, since for some time there has been discussion on the effects of gender in overall psychological development and specifically, the process of career development and occupational choice (Betz, 1992; Meier, 1991). In this case, gender has been shown in previous research to have a strong relationship with endorsement of certain vocational preferences and abilities. Examples of the latter would be that more males than females usually express affinity for Realistic occupations and tend to have higher average scores on measures of Spatial ability.

However, the relative lack of contribution with regard to socioeconomic status was somewhat unexpected. Some schools of thought, such as social systems theory (Osipow, 1983) have postulated that SES is likely to play a role in occupational choice. It has also been documented that educational attainment is correlated with SES, an element that seems to have potential for contributing to vocational preferences and skill development. Disproportionate numbers of high SES individuals might select Investigative occupations given their educational opportunities, aspirations and cultural expectations, while for the same reasons a higher number of lower SES respondents choose Realistic occupations. While it could be that SES does not extensively

factor into vocational decision-making, there are other reasons why these findings may have been as reported. One issue lies in the very small number of participants who met the criteria for high SES. In order to conduct a truly meaningful analysis, greater numbers of individuals would need to be represented at all SES levels. It is necessary to ensure representation at the higher and lower ends of the spectrum, since this is where most of the postulated differences should occur. In that the results of this study were inconclusive and many of the citations in the literature are quite dated (Osipow, 1983), this is a fertile area for future research projects.

Conclusions

For the practitioner, these results indicate that there is value in using instruments from each of the three primary domains of personality, interest and aptitude. Statistically and clinically, each is indicated as uniquely contributing to occupational selection. Accordingly, results derived from this study do not support extrapolation of evaluee performance based on any one vocational concept, such as interests or aptitudes, or measurement instrument. In fact, it indicates that for certain subpopulations which may have more within-group variability, close examination of results in each domain should be undertaken in the process of career counseling. These results also suggest that other variables be taken into consideration in interpreting results, such as level of career maturity which can be impacted by age, presence of disability, membership in an ethnically diverse group, or socioeconomic status (Crites, 1989; Leong, 1991; Luzzo, 1995).

Based on these results, a number of future research endeavors are recommended. One area that should be explored is the idea that

particular vocational interest groups are less homogenous with respect to aptitude scores or personality characteristics. Studies involving larger numbers of subjects, detailed within-group statistical analysis and tracking of vocational outcomes could generate important information on the existence of, and potential impact of vocational trait variability within occupational clusters. Other projects should look at the issue of concurrent validity for vocational measurement instruments, in order to establish whether any configuration of scales has a stronger relationship than others. It could be that the findings of this study would be quite different if interests were measured with an instrument of a different theoretical orientation, or with a personality instrument incorporating different traits.

On that same note, it would also be fruitful to include all scales for each measurement instrument to address relationships not hypothesized in the literature. In that the present study was exploratory in nature and with a basic objective to investigate an established model, only those subscales delineated by the model were included. It could well be that areas not taken into account by the model are stronger predictors than those identified by the model. Again, a larger scale project involving different combinations of assessment instruments and incorporating as many aptitudes and personality variables as possible would likely be of great help in generating a true picture of vocationally oriented, inter-domain relationships.

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